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STANDARDIZED PERFORMANCE TESTS OF COLLECTORS OF SOLAR THERMAL ENERGY - A STEEL FLAT-PLATE COLLECTOR WITH TWO TRANSPARENT COVERS AND A PROPRIETARY COATING

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16. Abstract

This preliminary data report gives basic test results of a flat-plate solar collector whose performance was determined in the NASA-Lewis solar simulator. The collector was tested over ranges of inlet temperatures, fluxes, and coolant flow rates. Collector efficiency is correlated in terms of inlet temperature and flux level.

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INTRODUCTION

An area presently being investigated by the NASA Lewis Research Center in its efforts to aid in the utilization of alternate energy sources is the use of solar energy for the heating and cooling of buildings. An important part of this effort is the evaluation of solar collectors which have the potential to be efficient, economical, and reliable.

This preliminary data report gives basic test results of a collector whose performance was determined in the NASA-Lewis solar simulator. In the interest of providing performance data on this collector to the technical community as quickly as possible, the basic test results reported herein are presented without evaluation. Detailed analyses and interpretation of these results may be presented in subsequent papers or reports by this Center. Some of the results contained in this report may be changed as warranted by reviews and evaluations, or by obtaining additional data on this collector.

Reference 1 describes the solar-simulator test facility, as well as the basic test procedure.

COLLECTOR DESCRIPTION

The collector was made by Southwestern Sheet Metal Works, Incorporated, El Paso, Texas. It consists of a 20-gage electrogalvanized steel absorber panel (absorbing area = 17.06 ft^2) and seven parallel galvanized steel flow channels. The flow channels are spaced 3-5/8 inches apart. The absorber panel is coated with a proprietary coating. The collector has two glass covers of 3/16-inch water-white crystal, with the outer cover being temperated glass (glass area = 17.32 ft^2). Insulation consisting of 4 inches of fiberglass is used to reduce conduction heat losses. A photograph of the collector on the test stand is shown in Figure 1.

COLLECTOR TEST RESULTS

Basic test results are given in Table 1. Since this collector was larger than the area of radiation provided by the solar simulator, it was necessary to use a "shield" approach as explained in Reference 1. This technique allows one to determine the efficiency of the entire collector even though only a portion of it is actually exposed to radiation. By using the analytical method outlined in Reference 1 for a collector tested with a "shield", the results given in Table I were used for a determination of the performance correlation given in Figure 2.

REFERENCES

1. Simon, F. F.: Flat-Plate Collector Performance Evaluation with a Solar Simulator as a Basis for Collector Selection and Performance Prediction, paper presented at the 1975 International Solar Energy Society Meeting, Los Angeles, California, July 28-August 1, 1975, NASA TMX-71793.

TABLE I - BASIC EXPERIMENTAL DATA

50/50 Water and Ethylene Glycol
Incident Angel = 0°
Tilt Angle = 57° Above Horizontal

Flow Per Radiated Surface Area lb/hr ft^2	Flow Gal/Min	Incident Radiation Flux Btu/hr ft^2	Fluid Outlet Temp.,°F	Fluid Inlet Temp.,°F	Ambient Temp.	Efficiency
15.313	0.32485	282.85	94.311	79.866	79.896	0.66597
15.920	0.32501	291.23	94.613	79.907	79.977	0.69232
15.233	0.31434	185.81	125.95	120.35	79.114	0.39493
15.271	0.31544	282.31	134.08	122.77	80.298	0.51388
15.069	0.31545	282.70	147.20	139.03	81.332	0.27345
30.888	0.63057	283.78	92.231	84.621	79.915	0.67935
30.610	0.63232	187.12	128.07	124.52	80.079	0.48705
30.540	0.63138	282.08	132.93	126.98	81.393	0.54116
30.283	0.63436	189.75	163.05	161.15	81.111	0.24070

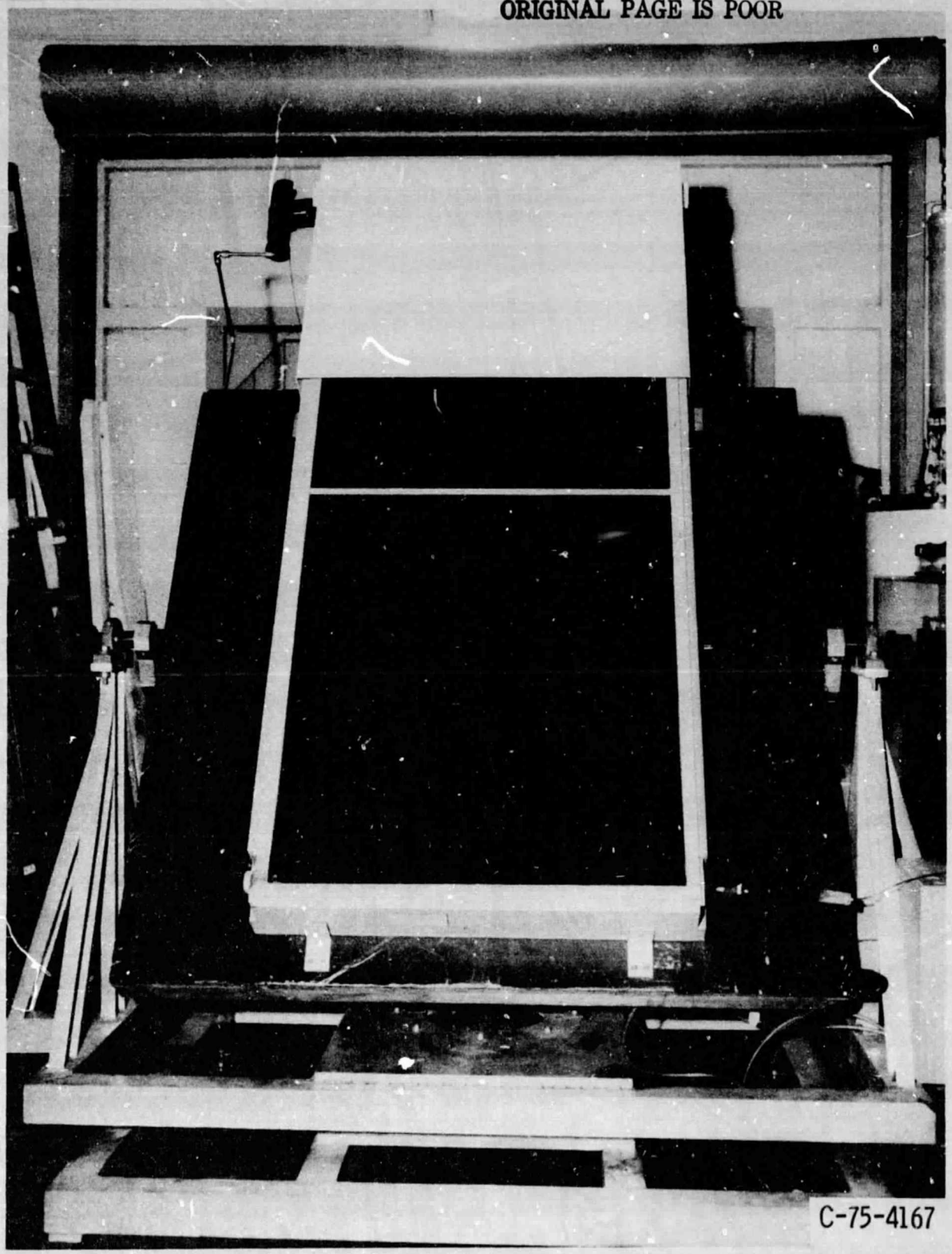

Figure 1. - Collector on test stand.

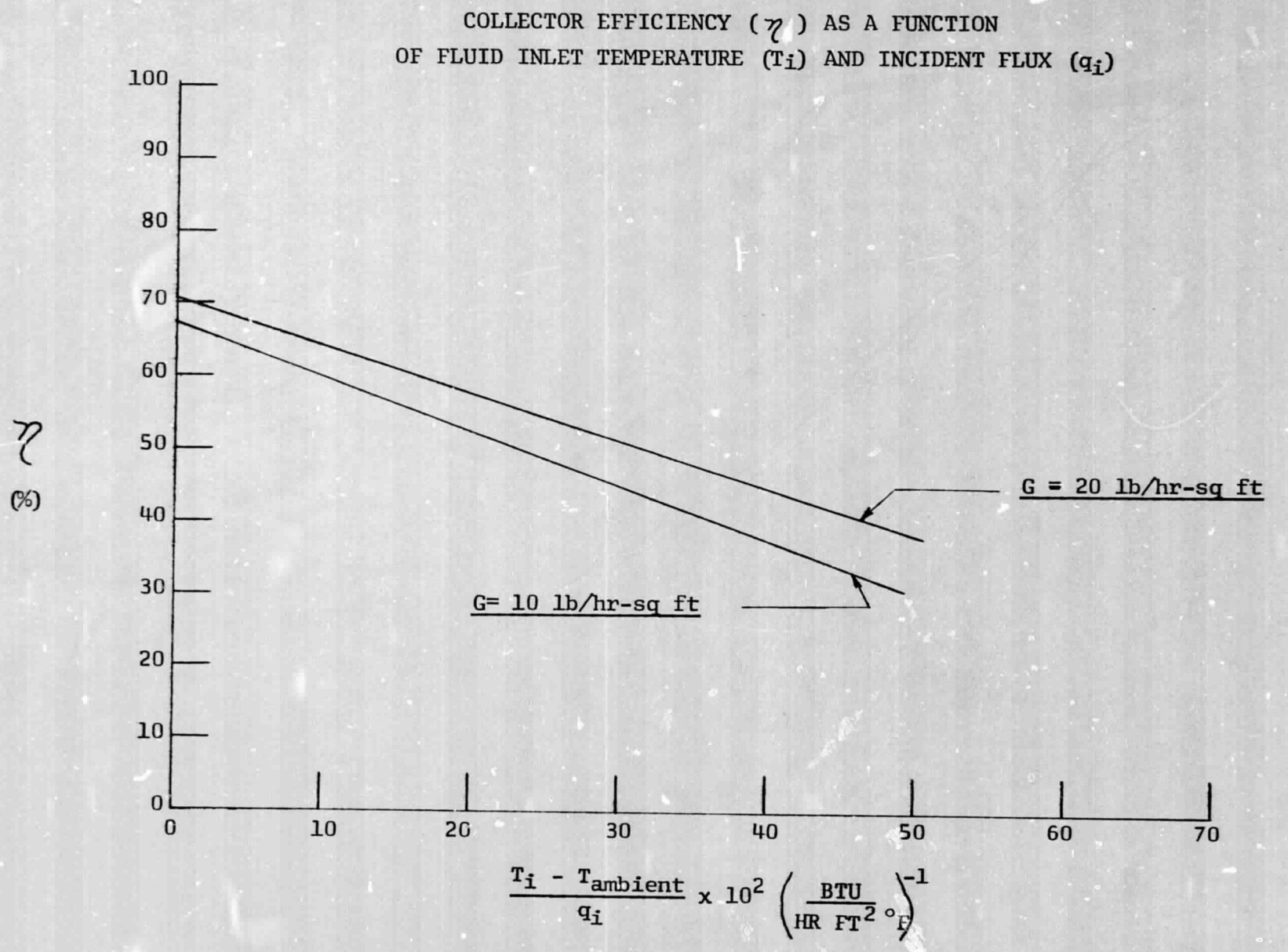

Figure 2. - Collector Performance Correlation